Electric Vehicle Battery Systems

Advanced Battery Management Technologies for Electric VehiclesOvercoming Barriers to Deployment of Plug-in Electric VehiclesIntelligent Computing in Smart Grid and Electrical VehiclesThermal Management of Electric Vehicle Battery SystemsTechnological Innovation for the Internet of ThingsElectric Vehicles in Energy SystemsAdvances in Battery Technologies for Electric VehiclesArtificial Intelligent Techniques for Electric and Hybrid Electric VehiclesBehaviour of Lithium-Ion Batteries in Electric VehiclesElectric Vehicle Integration into Modern Power NetworksModeling and Simulation for Electric Vehicle ApplicationsBatteries for Electric VehiclesElectric Vehicle Battery SystemsBattery Management Systems, Volume I: Battery ModelingNew Applications of Electric DrivesAdvances in Battery Manufacturing, Service, and Management SystemsReview of the Research Program of the U.S. DRIVE PartnershipElectric Vehicle Technology ExplainedBuild Your Own Electric Vehicle, Third EditionSimulation of Battery SystemsElectric and Hybrid-electric VehiclesElectric and Hybrid VehiclesMaterials for Advanced BatteriesNew Trends in Electrical Vehicle PowertrainsElectric VehiclesDer Antrieb von morgen 2019Lithium Metal Anodes and Rechargeable Lithium Metal BatteriesRecycling of Lithium-Ion BatteriesModeling, Dynamics, and Control of Electrified VehiclesFundamentals and Applications of Lithium-ion Batteries in Electric Drive VehiclesBattery Management Algorithm for Electric VehiclesElectric PowertrainPlug-In Electric VehiclesBattery Management Systems for Large Lithium Ion Battery PacksSustainable Supply Chain ManagementBattery Systems EngineeringElectric Vehicle Batteries: Moving from Research towards InnovationHybrid Electric Vehicle System Modeling and ControlEnergy Storage and Management for Electric VehiclesAlternative Fuels and Advanced Vehicle Technologies for Improved Environmental Performance

Advanced Battery Management Technologies for Electric Vehicles

The book presents interesting topics from the area of modeling and simulation of electric vehicles application. The results presented by the authors of the book chapters are very interesting and inspiring. The book will familiarize the readers with the solutions and enable the readers to enlarge them by their own research. It will be useful for students of Electrical Engineering; it helps them solve practical problems.

Overcoming Barriers to Deployment of Plug-in Electric Vehicles

Electric vehicles/hybrid electric vehicles (EV/HEV) commercialization is still a challenge in industries in terms of performance and cost. The performance along with cost reduction are two tradeoffs which need to be researched to arrive at an optimal solution. This book focuses on the convergence of various technologies involved in EV/HEV. The book brings together the research that is being carried out in the field of EV/HEV whose leading role is by optimization techniques with artificial intelligence (AI). Other featured research includes green drive schemes which involve the possible renewable energy sources integration to develop eco-friendly green vehicles, as well as Internet of Things (IoT)-based techniques for

EV/HEVs. Electric vehicle research involves multi-disciplinary expertise from electrical, electronics, mechanical engineering and computer science. Consequently, this book serves as a point of convergence wherein all these domains are addressed and merged and will serve as a potential resource for industrialists and researchers working in the domain of electric vehicles.

Intelligent Computing in Smart Grid and Electrical Vehicles

Electric Vehicle Battery Systems provides operational theory and design guidance for engineers and technicians working to design and develop efficient electric vehicle (EV) power sources. As Zero Emission Vehicles become a requirement in more areas of the world, the technology required to design and maintain their complex battery systems is needed not only by the vehicle designers, but by those who will provide recharging and maintenance services, as well as utility infrastructure providers. Includes fuel cell and hybrid vehicle applications. Written with cost and efficiency foremost in mind, Electric Vehicle Battery Systems offers essential details on failure mode analysis of VRLA, NiMH battery systems, the fast-charging of electric vehicle battery systems based on Pb-acid, NiMH, Li-ion technologies, and much more. Key coverage includes issues that can affect electric vehicle performance, such as total battery capacity, battery charging and discharging, and battery temperature constraints. The author also explores electric vehicle performance, battery testing (15 core performance tests provided), lithium-ion batteries, fuel cells and hybrid vehicles. In order to make a practical electric vehicle, a thorough understanding of the operation of a set of batteries in a pack is necessary. Expertly written and researched, Electric Vehicle Battery Systems will prove invaluable to automotive engineers, electronics and integrated circuit design engineers, and anyone whose interests involve electric vehicles and battery systems. * Addresses cost and efficiency as key elements in the design process * Provides comprehensive coverage of the theory, operation, and configuration of complex battery systems, including Pb-acid, NiMH, and Li-ion technologies * Provides comprehensive coverage of the theory, operation, and configuration of complex battery systems, including Pb-acid, NiMH, and Li-ion technologies

Thermal Management of Electric Vehicle Battery Systems

7.5 Case Study 4: Heat Transfer and Thermal Management of Electric Vehicle Batteries with Phase Change Materials -- 7.5.1 Introduction -- 7.5.2 System Description -- 7.5.3 Analysis -- 7.5.4 Results and Discussion -- 7.5.5 Closing Remarks -- 7.6 Case Study 5: Experimental and Theoretical Investigation of Novel Phase Change Materials For Thermal Applications -- 7.6.1 Introduction -- 7.6.2 System Description -- 7.6.3 Analysis -- 7.6.4 Results and Discussion -- 7.6.5 Closing Remarks -- Nomenclature -- References -- Chapter 8 Alternative Dimensions and Future Expectations -- 8.1 Introduction -- 8.2 Outstanding Challenges -- 8.2.1 Consumer Perceptions -- 8.2.2 Socio-Technical Factors -- 8.2.3 Self-Reinforcing Processes -- 8.3 Emerging EV Technologies and Trends -- 8.3.1 Active Roads -- 8.3.2 V2X and Smart Grid -- 8.3.3 Battery Swapping -- 8.3.4 Battery Second Use -- 8.4 Future BTM Technologies -- 8.4.1 Thermoelectric Materials -- 8.4.2 Magnetic Cooling -- 8.4.3 Piezoelectric Fans/Dual Cooling Jets -- 8.4.4 Other Potential BTMSs -- 8.5 Concluding Remarks -- Nomenclature -- Study Questions/Problems -- References -- Index -- EULA

Technological Innovation for the Internet of Things

This timely book provides you with a solid understanding of battery management systems (BMS) in large Li-Ion battery packs, describing the important technical challenges in this field and exploring the most effective solutions. You find in-depth discussions on BMS topologies, functions, and complexities, helping you determine which permutation is right for your application. Packed with numerous graphics, tables, and images, the book explains the OC whysOCO and OC howsOCO of Li-Ion BMS design, installation, configuration and troubleshooting. This hands-on resource includes an unbiased description and comparison of all the off-the-shelf Li-Ion BMSs available today. Moreover, it explains how using the correct one for a given application can help to get a Li-Ion pack up and running in little time at low cost."

Electric Vehicles in Energy Systems

Addresses the methodology and theoretical foundation of battery manufacturing, service and management systems (BM2S2), and discusses the issues and challenges in these areas This book brings together experts in the field to highlight the cutting edge research advances in BM2S2 and to promote an innovative integrated research framework responding to the challenges. There are three major parts included in this book: manufacturing, service, and management. The first part focuses on battery manufacturing systems, including modeling, analysis, design and control, as well as economic and risk analyses. The second part focuses on information technology's impact on service systems, such as data-driven reliability modeling, failure prognosis, and service decision making methodologies for battery services. The third part addresses battery management systems (BMS) for control and optimization of battery cells, operations, and hybrid storage systems to ensure overall performance and safety, as well as EV management. The contributors consist of experts from universities, industry research centers, and government agency. In addition, this book: Provides comprehensive overviews of lithium-ion battery and battery electrical vehicle manufacturing, as well as economic returns and government support Introduces integrated models for quality propagation and productivity improvement, as well as indicators for bottleneck identification and mitigation in battery manufacturing Covers models and diagnosis algorithms for battery SOC and SOH estimation, data-driven prognosis algorithms for predicting the remaining useful life (RUL) of battery SOC and SOH Presents mathematical models and novel structure of battery equalizers in battery management systems (BMS) Reviews the state of the art of battery, supercapacitor, and battery-supercapacitor hybrid energy storage systems (HESSs) for advanced electric vehicle applications Advances in Battery Manufacturing, Services, and Management Systems is written for researchers and engineers working on battery manufacturing, service, operations, logistics, and management. It can also serve as a reference for senior undergraduate and graduate students interested in BM2S2.

Advances in Battery Technologies for Electric Vehicles

A comprehensive examination of advanced battery management technologies and practices in modern electric vehicles Policies surrounding energy sustainability and

environmental impact have become of increasing interest to governments, industries, and the general public worldwide. Policies embracing strategies that reduce fossil fuel dependency and greenhouse gas emissions have driven the widespread adoption of electric vehicles (EVs), including hybrid electric vehicles (HEVs), pure electric vehicles (PEVs) and plug-in electric vehicles (PHEVs). Battery management systems (BMSs) are crucial components of such vehicles, protecting a battery system from operating outside its Safe Operating Area (SOA), monitoring its working conditions, calculating and reporting its states, and charging and balancing the battery system. Advanced Battery Management Technologies for Electric Vehicles is a compilation of contemporary model-based state estimation methods and battery charging and balancing techniques, providing readers with practical knowledge of both fundamental concepts and practical applications. This timely and highly-relevant text covers essential areas such as battery modeling and battery state of charge, energy, health and power estimation methods. Clear and accurate background information, relevant case studies, chapter summaries, and reference citations help readers to fully comprehend each topic in a practical context. Offers up-to-date coverage of modern battery management technology and practice Provides case studies of real-world engineering applications Guides readers from electric vehicle fundamentals to advanced battery management topics Includes chapter introductions and summaries, case studies, and color charts, graphs, and illustrations Suitable for advanced undergraduate and graduate coursework, Advanced Battery Management Technologies for Electric Vehicles is equally valuable as a reference for professional researchers and engineers.

Artificial Intelligent Techniques for Electric and Hybrid Electric Vehicles

This book constitutes the refereed proceedings of the 4th IFIP WG 5.5/SOCOLNET Doctoral Conference on Computing, Electrical and Industrial Systems, DoCEIS 2013, held in Costa de Caparica, Portugal, in April 2013. The 69 revised full papers were carefully reviewed and selected from numerous submissions. They cover a wide spectrum of topics ranging from collaborative enterprise networks to microelectronics. The papers are organized in the following topical sections: collaborative enterprise networks; service orientation; intelligent computational systems; computational systems; computational systems applications; perceptional systems; robotics and manufacturing; embedded systems and Petri nets; control and decision; integration of power electronics systems with ICT; energy generation; energy distribution; energy transformation; optimization techniques in energy; telecommunications; electronics: devices design; electronics: amplifiers; electronics: RF applications; and electronics: applications.

Behaviour of Lithium-Ion Batteries in Electric Vehicles

Large-scale battery packs are needed in hybrid and electric vehicles, utilities grid backup and storage, and frequency-regulation applications. In order to maximize battery-pack safety, longevity, and performance, it is important to understand how battery cells work. This first of its kind new resource focuses on developing a mathematical understanding of how electrochemical (battery) cells work, both internally and externally. This comprehensive resource derives physics-based

micro-scale model equations, then continuum-scale model equations, and finally reduced-order model equations. This book describes the commonly used equivalent-circuit type battery model and develops equations for superior physics-based models of lithium-ion cells at different length scales. This resource also presents a breakthrough technology called the "discrete-time realization algorithm" that automatically converts physics-based models into high-fidelity approximate reduced-order models.

Electric Vehicle Integration into Modern Power Networks

This book constitutes the third part of the refereed proceedings of the International Conference on Life System Modeling and Simulation, LSMS 2014, and of the International Conference on Intelligent Computing for Sustainable Energy and Environment, ICSEE 2014, held in Shanghai, China, in September 2014. The 159 revised full papers presented in the three volumes of CCIS 461-463 were carefully reviewed and selected from 572 submissions. The papers of this volume are organized in topical sections on computational intelligence in utilization of clean and renewable energy resources, including fuel cell, hydrogen, solar and winder power, marine and biomass; intelligent modeling, control and supervision for energy saving and pollution reduction; intelligent methods in developing electric vehicles, engines and equipment; intelligent computing and control in distributed power generation systems; intelligent modeling, simulation and control of power electronics and power networks; intelligent road management and electricity marketing strategies; intelligent water treatment and waste management technologies; integration of electric vehicles with smart grid.

Modeling and Simulation for Electric Vehicle Applications

In the past few years, interest in plug-in electric vehicles (PEVs) has grown. Advances in battery and other technologies, new federal standards for carbon-dioxide emissions and fuel economy, state zero-emission-vehicle requirements, and the current administration's goal of putting millions of alternative-fuel vehicles on the road have all highlighted PEVs as a transportation alternative. Consumers are also beginning to recognize the advantages of PEVs over conventional vehicles, such as lower operating costs, smoother operation, and better acceleration; the ability to fuel up at home; and zero tailpipe emissions when the vehicle operates solely on its battery. There are, however, barriers to PEV deployment, including the vehicle cost, the short all-electric driving range, the long battery charging time, uncertainties about battery life, the few choices of vehicle models, and the need for a charging infrastructure to support PEVs. What should industry do to improve the performance of PEVs and make them more attractive to consumers? At the request of Congress, Overcoming Barriers to Deployment of Plug-in Electric Vehicles identifies barriers to the introduction of electric vehicles and recommends ways to mitigate these barriers. This report examines the characteristics and capabilities of electric vehicle technologies, such as cost, performance, range, safety, and durability, and assesses how these factors might create barriers to widespread deployment. Overcoming Barriers to Deployment of Plug-in Electric Vehicles provides an overview of the current status of PEVs and makes recommendations to spur the industry and increase the attractiveness of this promising technology for consumers. Through consideration of consumer

behaviors, tax incentives, business models, incentive programs, and infrastructure needs, this book studies the state of the industry and makes recommendations to further its development and acceptance.

Batteries for Electric Vehicles

Modelling, Dynamics and Control of Electrified Vehicles provides a systematic overview of EV-related key components, including batteries, electric motors, ultracapacitors and system-level approaches, such as energy management systems, multi-source energy optimization, transmission design and control, braking system control and vehicle dynamics control. In addition, the book covers selected advanced topics, including Smart Grid and connected vehicles. This book shows how EV work, how to design them, how to save energy with them, and how to maintain their safety. The book aims to be an all-in-one reference for readers who are interested in EVs, or those trying to understand its state-of-the-art technologies and future trends. Offers a comprehensive knowledge of the multidisciplinary research related to EVs and a system-level understanding of technologies Provides the state-of-the-art technologies and future trends Covers the fundamentals of EVs and their methodologies Written by successful researchers that show the deep understanding of EVs

Electric Vehicle Battery Systems

Advances in Battery Technologies for Electric Vehicles provides an in-depth look into the research being conducted on the development of more efficient batteries capable of long distance travel. The text contains an introductory section on the market for battery and hybrid electric vehicles, then thoroughly presents the latest on lithium-ion battery technology. Readers will find sections on battery pack design and management, a discussion of the infrastructure required for the creation of a battery powered transport network, and coverage of the issues involved with end-of-life management for these types of batteries. Provides an in-depth look into new research on the development of more efficient, long distance travel batteries Contains an introductory section on the market for battery and hybrid electric vehicles Discusses battery pack design and management and the issues involved with end-of-life management for these types of batteries

Battery Management Systems, Volume I: Battery Modeling

This Special Edition of Energies on "Energy Storage and Management for Electric Vehicles" draws together a collection of research papers that critically evaluates key areas of innovation and novelty when designing and managing the high-voltage battery system within an electrified powertrain. The addressed topics include design optimisation, mathematical modelling, control engineering, thermal management, and component sizing.

New Applications of Electric Drives

Compilation of SAE technical papers published from 2008-2010.

Advances in Battery Manufacturing, Service, and Management Systems

The why, what and how of the electric vehicle powertrain Empowers engineering professionals and students with the knowledge and skills required to engineer electric vehicle powertrain architectures, energy storage systems, power electronics converters and electric drives. The modern electric powertrain is relatively new for the automotive industry, and engineers are challenged with designing affordable, efficient and high-performance electric powertrains as the industry undergoes a technological evolution. Co-authored by two electric vehicle (EV) engineers with decades of experience designing and putting into production all of the powertrain technologies presented, this book provides readers with the hands-on knowledge, skills and expertise they need to rise to that challenge. This four-part practical guide provides a comprehensive review of battery, hybrid and fuel cell EV systems and the associated energy sources, power electronics, machines, and drives. The first part of the book begins with a historical overview of electromobility and the related environmental impacts motivating the development of the electric powertrain. Vehicular requirements for electromechanical propulsion are then presented. Battery electric vehicles (BEV), fuel cell electric vehicles (FCEV), and conventional and hybrid electric vehicles (HEV) are then described, contrasted and compared for vehicle propulsion. The second part of the book features in-depth analysis of the electric powertrain traction machines, with a particular focus on the induction machine and the surface- and interior-permanent magnet ac machines. The brushed dc machine is also considered due to its ease of operation and understanding, and its historical place, especially as the traction machine on NASA's Mars rovers. The third part of the book features the theory and applications for the propulsion, charging, accessory, and auxiliary power electronics converters. Chapters are presented on isolated and non-isolated dc-dc converters, traction inverters, and battery charging. The fourth part presents the introductory and applied electromagnetism required as a foundation throughout the book. • Introduces and holistically integrates the key EV powertrain technologies. • Provides a comprehensive overview of existing and emerging automotive solutions. • Provides experience-based expertise for vehicular and powertrain system and sub-system level study, design, and optimization. • Presents many examples of powertrain technologies from leading manufacturers. • Discusses the dc traction machines of the Mars rovers, the ultimate EVs from NASA. • Investigates the environmental motivating factors and impacts of electromobility. • Presents a structured university teaching stream from introductory undergraduate to postgraduate. • Includes real-world problems and assignments of use to design engineers, researchers, and students alike. • Features a companion website with numerous references, problems, solutions, and practical assignments. • Includes introductory material throughout the book for the general scientific reader. • Contains essential reading for government regulators and policy makers. Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles is an important professional resource for practitioners and researchers in the battery, hybrid, and fuel cell EV transportation industry. The book is a structured holistic textbook for the teaching of the fundamental theories and applications of energy sources, power electronics, and electric machines and drives to engineering undergraduate and postgraduate students. Textbook Structure and Suggested Teaching Curriculum This is primarily

an engineering textbook covering the automotive powertrain, energy storage and energy conversion, power electronics, and electrical machines. A significant additional focus is placed on the engineering design, the energy for transportation, and the related environmental impacts. This textbook is an educational tool for practicing engineers and others, such as transportation policy planners and regulators. The modern automobile is used as the vehicle upon which to base the theory and applications, which makes the book a useful educational reference for our industry colleagues, from chemists to engineers. This material is also written to be of interest to the general reader, who may have little or no interest in the power electronics and machines. Introductory science, mathematics, and an inquiring mind suffice for some chapters. The general reader can read the introduction to each of the chapters and move to the next as soon as the material gets too advanced for him or her. Part I Vehicles and Energy Sources Chapter 1 Electromobility and the Environment Chapter 2 Vehicle Dynamics Chapter 3 Batteries Chapter 4 Fuel Cells Chapter 5 Conventional and Hybrid Powertrains Part II Electrical Machines Chapter 6 Introduction to Traction Machines Chapter 7 The Brushed DC Machine Chapter 8 Induction Machines Chapter 9 Surface-permanent-magnet AC Machines Chapter 10: Interior-permanent-magnet AC Machines Part III Power Electronics Chapter 11 DC-DC Converters Chapter 12 Isolated DC-DC Converters Chapter 13 Traction Drives and Three-phase Inverters Chapter 14 Battery Charging Chapter 15 Control of the Electric Drive Part IV Basics Chapter 16 Introduction to Electromagnetism, Ferromagnetism, and Electromechanical Energy Conversion The first third of the book (Chapters 1 to 6), plus parts of Chapters 14 and 16, can be taught to the general science or engineering student in the second or third year. It covers the introductory automotive material using basic concepts from mechanical, electrical, environmental, and electrochemical engineering. Chapter 14 on electrical charging and Chapter 16 on electromagnetism can also be used as a general introduction to electrical engineering. The basics of electromagnetism, ferromagnetism and electromechanical energy conversion (Chapter 16) and dc machines (Chapter 7) can be taught to second year (sophomore) engineering students who have completed introductory electrical circuits and physics. The third year (junior) students typically have covered ac circuit analysis, and so they can cover ac machines, such as the induction machine (Chapter 8) and the surface permanent-magnet ac machine (Chapter 9). As the students typically have studied control theory, they can investigate the control of the speed and torque loops of the motor drive (Chapter 15). Power electronics, featuring non-isolated buck and boost converters (Chapter 11), can also be introduced in the third year. The final-year (senior) students can then go on to cover the more advanced technologies of the interior-permanent-magnet ac machine (Chapter 10). Isolated power converters (Chapter 12), such as the full-bridge and resonant converters, inverters (Chapter 13), and power-factor-corrected battery chargers (Chapter 14), are covered in the power electronics section. This material can also be covered at the introductory postgraduate level. Various homework, simulation, and research exercises are presented throughout the textbook. The reader is encouraged to attempt these exercises as part of the learning experience. Instructors are encouraged to contact the author, John Hayes, direct to discuss course content or structure.

Review of the Research Program of the U.S. DRIVE Partnership

This book addresses recycling technologies for many of the valuable and scarce materials from spent lithium-ion batteries. A successful transition to electric mobility will result in large volumes of these. The book discusses engineering issues in the entire process chain from disassembly over mechanical conditioning to chemical treatment. A framework for environmental and economic evaluation is presented and recommendations for researchers as well as for potential operators are derived.

Electric Vehicle Technology Explained

The idea of a NATO Science Committee Institute on "Materials for Advanced Batteries" was suggested to JB and DWM by Dr. A. G. Chynoweth. His idea was to bring together experts in the field over the entire spectrum of pure research to applied research in order to familiarize everyone with potentially interesting new systems and the problems involved in their development. Dr. M. C. B. Hotz and Professor M. N. Ozdas were instrumental in helping organize this meeting as a NATO Advanced Science Institute. An organlzlng committee consisting of the three of us along with W. A. Adams, U. v Alpen, J. Casey and J. Rouxel organized the program. The program consisted of plenary talks and poster papers which are included in this volume. Nearly half the time of the conference was spent in study groups. The aim of these groups was to assess the status of several key aspects of batteries and prospects for research opportunities in each. The study groups and their chairmen were: Current status and new systems J. Broadhead High temperature systems W. A. Adams Interface problems B. C. H. Steele Electrolytes U. v Alpen Electrode materials J. Rouxel These discussions are summarized in this volume. We and all the conference participants are most grateful to Professor J. Rouxel for suggesting the Aussois conference site, and to both he and Dr. M. Armand for handling local arrangements.

Build Your Own Electric Vehicle, Third Edition

Einer der inhaltlichen Schwerpunkte des Tagungsbands zur ATZlive-Veranstaltung "Der Antrieb von morgen 2019" wird die Information zum aktuellen Stand der Antriebsentwicklungen sein. Die Tagung ist eine unverzichtbare Plattform für den Wissens- und Gedankenaustausch von Motoren- und Fahrzeugherstellern, deren Zulieferer und Entwicklungspartner, Lehrende und Ingenieure von Universitäten und Hochschulen, Vertreter von Behörden und Verbänden sowie für Techniker, die in diesem Themengebiet aktiv sind.

Simulation of Battery Systems

The electric vehicle and plug-in hybrid electric vehicle play a fundamental role in the forthcoming new paradigms of mobility and energy models. The electrification of the transport sector would lead to advantages in terms of energy efficiency and reduction of greenhouse gas emissions, but would also be a great opportunity for the introduction of renewable sources in the electricity sector. The chapters in this book show a diversity of current and new developments in the electrification of the transport sector seen from the electric vehicle point of view: first, the related technologies with design, control and supervision, second, the powertrain electric

motor efficiency and reliability and, third, the deployment issues regarding renewable sources integration and charging facilities. This is precisely the purpose of this book, that is, to contribute to the literature about current research and development activities related to new trends in electric vehicle power trains.

Electric and Hybrid-electric Vehicles

This edited volume presents research results of the PPP European Green Vehicle Initiative (EGVI), focusing on electric vehicle batteries. Electrification is one road towards sustainable road transportation, and battery technology is one of the key enabling technologies. However, at the same time, battery technology is one of the main obstacles for a broad commercial launch of electric vehicles. This book includes research contributions which try to bridge the gap between research and innovation in the field of battery technology for electric vehicles. The target audience primarily comprises researchers and experts in the field.

Electric and Hybrid Vehicles

This book surveys state-of-the-art research on and developments in lithium-ion batteries for hybrid and electric vehicles. It summarizes their features in terms of performance, cost, service life, management, charging facilities, and safety. Vehicle electrification is now commonly accepted as a means of reducing fossil-fuels consumption and air pollution. At present, every electric vehicle on the road is powered by a lithium-ion battery. Currently, batteries based on lithium-ion technology are ranked first in terms of performance, reliability and safety. Though other systems, e.g., metal-air, lithium-sulphur, solid state, and aluminium-ion, are now being investigated, the lithium-ion system is likely to dominate for at least the next decade – which is why several manufacturers, e.g., Toyota, Nissan and Tesla, are chiefly focusing on this technology. Providing comprehensive information on lithium-ion batteries, the book includes contributions by the world's leading experts on Li-ion batteries and vehicles.

Materials for Advanced Batteries

Electric and Hybrid Vehicles: Power Sources, Models, Sustainability, Infrastructure and the Market reviews the performance, cost, safety, and sustainability of battery systems for hybrid electric vehicles (HEVs) and electric vehicles (EVs), including nickel-metal hydride batteries and Li-ion batteries. Throughout this book, especially in the first chapters, alternative vehicles with different power trains are compared in terms of lifetime cost, fuel consumption, and environmental impact. The emissions of greenhouse gases are particularly dealt with. The improvement of the battery, or fuel cell, performance and governmental incentives will play a fundamental role in determining how far and how substantial alternative vehicles will penetrate into the market. An adequate recharging infrastructure is of paramount importance for the diffusion of vehicles powered by batteries and fuel cells, as it may contribute to overcome the so-called range anxiety."" Thus, proposed battery charging techniques are summarized and hydrogen refueling stations are described. The final chapter reviews the state of the art of the current models of hybrid and electric vehicles along with the powertrain solutions adopted

by the major automakers. Contributions from the worlds leading industry and research experts Executive summaries of specific case studies Information on basic research and application approaches

New Trends in Electrical Vehicle Powertrains

This book discusses the technical, economic, and environmental aspects of electric vehicles and their impact on electrical grids and energy systems. The book is divided into three parts that include load modeling, integration and optimization, and environmental evaluation. Theoretical background and practical examples accompany each section and the authors include helpful tips and hints in the load modeling and optimization sections. This book is intended to be a useful tool for undergraduate and graduate students, researchers and engineers who are trying to solve power and engineering problems related electric vehicles. Provides optimization techniques and their applications for energy systems; Discusses the economic and environmental perspectives of electric vehicles; Contains the most comprehensive information about electric vehicles in a single source.

Electric Vehicles

Review of the Research Program of the U.S. DRIVE Partnership: Fourth Report follows on three previous NRC reviews of the FreedomCAR and Fuel Partnership, which was the predecessor of the U.S. DRIVE Partnership (NRC, 2005, 2008a, 2010). The U.S. DRIVE (Driving Research and Innovation for Vehicle Efficiency and Energy Sustainability) vision, according to the charter of the Partnership, is this: American consumers have a broad range of affordable personal transportation choices that reduce petroleum consumption and significantly reduce harmful emissions from the transportation sector. Its mission is as follows: accelerate the development of pre-competitive and innovative technologies to enable a full range of efficient and clean advanced light-duty vehicles (LDVs), as well as related energy infrastructure. The Partnership focuses on precompetitive research and development (R&D) that can help to accelerate the emergence of advanced technologies to be commercialization-feasible. The guidance for the work of the U.S. DRIVE Partnership as well as the priority setting and targets for needed research are provided by joint industry/government technical teams. This structure has been demonstrated to be an effective means of identifying high-priority, long-term precompetitive research needs for each technology with which the Partnership is involved. Technical areas in which research and development as well as technology validation programs have been pursued include the following: internal combustion engines (ICEs) potentially operating on conventional and various alternative fuels, automotive fuel cell power systems, hydrogen storage systems (especially onboard vehicles), batteries and other forms of electrochemical energy storage, electric propulsion systems, hydrogen production and delivery, and materials leading to vehicle weight reductions.

Der Antrieb von morgen 2019

A complete all-in-one reference on the important interdisciplinary topic of Battery Systems Engineering Focusing on the interdisciplinary area of battery systems

engineering, this book provides the background, models, solution techniques, and systems theory that are necessary for the development of advanced battery management systems. It covers the topic from the perspective of basic electrochemistry as well as systems engineering topics and provides a basis for battery modeling for system engineering of electric and hybrid electric vehicle platforms. This original approach gives a useful overview for systems engineers in chemical, mechanical, electrical, or aerospace engineering who are interested in learning more about batteries and how to use them effectively. Chemists, material scientists, and mathematical modelers can also benefit from this book by learning how their expertise affects battery management. Approaches a topic which has experienced phenomenal growth in recent years Topics covered include: Electrochemistry; Governing Equations; Discretization Methods; System Response and Battery Management Systems Include tables, illustrations, photographs, graphs, worked examples, homework problems, and references, to thoroughly illustrate key material Ideal for engineers working in the mechanical, electrical, and chemical fields as well as graduate students in these areas A valuable resource for Scientists and Engineers working in the battery or electric vehicle industries, Graduate students in mechanical engineering, electrical engineering, chemical engineering.

Lithium Metal Anodes and Rechargeable Lithium Metal Batteries

The book is a collection of studies dedicated to different perspectives of three dimensions or pillars of the sustainability of supply chain and supply chain management - economic, environmental, and social - and other aspects related to performance evaluation, optimization, and modelling of and for sustainable supply chain management, and thus presents another valuable contribution to sustainable development and sustainable way of life.

Recycling of Lithium-Ion Batteries

Electric Vehicle Integration into Modern Power Networks provides coverage of the challenges and opportunities posed by the progressive integration of electric drive vehicles. Starting with a thorough overview of the current electric vehicle and battery state-of-the-art, this work describes dynamic software tools to assess the impacts resulting from the electric vehicles deployment on the steady state and dynamic operation of electricity grids, identifies strategies to mitigate them and the possibility to support simultaneously large-scale integration of renewable energy sources. New business models and control management architectures, as well as the communication infrastructure required to integrate electric vehicles as active demand are presented. Finally, regulatory issues of integrating electric vehicles into modern power systems are addressed. Inspired by two courses held under the EES-UETP umbrella in 2010 and 2011, this contributed volume consists of nine chapters written by leading researchers and professionals from the industry as well as academia.

Modeling, Dynamics, and Control of Electrified Vehicles

The market for electrified light-duty vehicles (also called passenger vehicles; including passenger cars, pickup trucks, SUVs, and minivans) has grown since the 1990s. During this decade, the first contemporary hybrid-electric vehicle debuted on the global market, followed by the introduction of other types of electric vehicles (EVs). By 2018, electric vehicles made up 4.2% of the 16.9 million new light-duty vehicles sold in the United States that year. Meanwhile, charging infrastructure grew in response to rising electric vehicle ownership, increasing from 3,394 charging stations in 2011 to 78,301 in 2019. However, many locations have sparse or no public charging infrastructure. Electric motors and traction battery packs-most commonly made up of lithium-ion battery cells-set EVs apart from internal combustion engine vehicles (ICEVs). The battery pack provides power to the motor that drives the vehicle. At times, the motor acts as a generator, sending electricity back to the battery. The broad categories of EVs can be identified by whether they have an internal combustion engine (i.e., hybrid vehicles) and whether the battery pack can be charged by external electricity (i.e., plug-in electric vehicles). The numerous vehicle technologies further determine characteristics such as fuel economy rating, driving range, and greenhouse gas emissions. EVs can be separated into three broad categories: * Hybrid-electric vehicles (HEVs): The internal combustion engine primarily powers the wheels. The battery pack and electric motor provide supplemental power. * Plug-in hybrid-electric vehicles (PHEVs): The battery pack can be charged by an external source of electricity. Depending on the model, primary power to the wheels may be supplied by the battery pack and electric motor, the internal combustion engine, or a combination. * All-electric vehicles (AEVs; also called battery-electric vehicles or BEVs): The battery pack must be charged via an external source of electricity. The battery pack and electric motor power the wheels. Current technology offers three levels of charging for plug-in EVs. Level 1 and Level 2 are currently the most widely accessible with standardized vehicle connectors and charge ports that can be set up for at-home charging. Level 3 (also called DC fast charging) offers the fastest charging rates on the market but is not available for at-home installation due to high voltage. Vehicle connectors and corresponding charge ports for Level 3 are also not standardized, with three different systems currently in use by different vehicle manufacturers. Some research has raised concerns regarding the potential impact of fast charging on battery performance, resulting in technology development aimed at addressing potential capacity loss and decreased charging cycles. As an emergent technology area, EVs present a number of issues for consideration. The fuel sources used to generate the electricity to charge PHEVs and AEVs are a major factor in determining EV greenhouse gas emissions relative to ICEVs. Per-mile EV emissions vary geographically and with the time of day and year that charging takes place. Growing demand for lithium-ion batteries also shifts the material requirements of the vehicle market from fuels for combustion to minerals and other materials for battery production. A growing EV market may encourage new strategies around the supply and refining of raw materials, ability to manufacture batteries, and end-of-life management for batteries that are no longer suitable for use in vehicles.Support for EV deployment stems from, among other things, federal and state policies establishing manufacturing rebates, tax credits for purchases, funding for research and development, and standards for fuel economy and emissions. These policies include the Plug-In Electric Vehicle Tax Credit, and the coordinated Corporate Average Fuel Economy (CAFE) standards and emissions standards for vehicles.

Fundamentals and Applications of Lithium-ion Batteries in Electric Drive Vehicles

This fundamental guide teaches readers the basics of battery design for electric vehicles. Working through this book, you will understand how to optimise battery performance and functionality, whilst minimising costs and maximising durability. Beginning with the basic concepts of electrochemistry, the book moves on to describe implementation, control and management of batteries in real vehicles, with respect to the battery materials. It describes how to select cells and batteries with explanations of the advantages and disadvantages of different battery chemistries, enabling readers to put their knowledge into practice and make informed and successful design decisions, with a thorough understanding of the trade-offs involved. The first of its kind, and written by an industry expert with experience in academia, this is an ideal resource for both students and researchers in the fields of battery research and development as well as for professionals in the automotive industry extending their interest towards electric vehicles.

Battery Management Algorithm for Electric Vehicles

BUILD, CONVERT, OR BUY A STATE-OF-THE-ART ELECTRIC VEHICLE Thoroughly revised and expanded, Build Your Own Electric Vehicle, Third Edition, is your go-to guide for converting an internal combustion engine vehicle to electric or building an EV from the ground up. You'll also find out about the wide variety of EVs available for purchase and how they're being built. This new edition details all the latest breakthroughs, including AC propulsion and regenerative braking systems, intelligent controllers, batteries, and charging technologies. Filled with updated photos, this cutting-edge resource fully describes each component--motor, battery, controller, charger, and chassis--and provides illustrated, step-by-step instructions on how to assemble all the parts. Exclusive web content features current supplier and dealer lists. Custom-built for environmentalists, engineers, students, hobbyists, and mechanics, this hands-on guide puts you in the fast lane toward a cost-effective, reliable green machine. Build Your Own Electric Vehicle, Third Edition, covers: Environmental impact and energy savings The best EV for you--purchase trade-offs, conversion trade-offs, and conversion costs Chassis and design Different types of electric motors and controllers Lithium EV batteries Chargers and electrical systems EV builds and conversions Licensing and insuring your EV Driving and maintenance List of manufacturers and dealers regularly updated on website

Electric Powertrain

Plug-In Electric Vehicles

Plug-in electric vehicles are coming. Major automakers plan to commercialize their first models soon, while Israel and Denmark have ambitious plans to electrify large portions of their vehicle fleets. No technology has greater potential to end the United States' crippling dependence on oil, which leaves the nation vulnerable to price shocks, supply disruptions, environmental degradation, and national security

threats including terrorism. What does the future hold for this critical technology, and what should the U.S. government do to promote it? Hybrid vehicles now number more than one million on America's roads, and they are in high demand from consumers. The next major technological step is the plug-in electric vehicle. It combines an internal combustion engine and electric motor, just as hybrids do. But unlike their precursors, PEVs can be recharged from standard electric outlets, meaning the vehicles would no longer be dependent on oil. Widespread growth in the use of PEVs would dramatically reduce oil dependence, cut driving costs and reduce pollution from vehicles. National security would be enhanced, as reduced oil dependence decreases the leverage and resources of petroleum exporters. Brookings fellow David Sandalow heads up an authoritative team of experts including former government officials, private-sector analysts, academic experts, and nongovernmental advocates. Together they explain the current landscape for PEVs: the technology, the economics, and the implications for national security and the environment. They examine how the national interest could be served by federal promotion and investment in PEVs. For example, can tax or procurement policy advance the cause of PEVs? Should the public sector contribute to greater research and development? Should the government insist on PEVs to replenish its huge fleet of official vehicles? Plug-in electric vehicles are coming. But how soon, in what numbers, and to what effect? Federal policies in the years ahead will go a long way toward answering those questions. David Sandalow and his colleagues examine what could be done in that regard, as well as what should be done.

Battery Management Systems for Large Lithium Ion Battery Packs

Simulation of Battery Systems: Fundamentals and Applications covers both the fundamental and technical aspects of battery systems. It is a solid reference on the simulation of battery dynamics based on fundamental governing equations of porous electrodes. Sections cover the fundamentals of electrochemistry and how to obtain electrochemical governing equations for porous electrodes, the governing equations and physical characteristics of lead-acid batteries, the physical characteristics of zinc-silver oxide batteries, experimental tests and parameters necessary for simulation and validation of battery dynamics, and an environmental impact and techno-economic assessment of battery systems for different applications, such as electric vehicles and battery energy storage. The book contains introductory information, with most chapters requiring a solid background in engineering or applied science. Battery industrial companies who want to improve their industrial batteries will also find this book useful. Includes carefully selected in-text problems, case studies and illustrative examples Features representative chapter-end problems, along with practical systems and applications Covers various numerical methods, including those based on CFD and optimization, also including free codes and databases

Sustainable Supply Chain Management

This book provides comprehensive coverage of Lithium (Li) metal anodes for rechargeable batteries. Li is an ideal anode material for rechargeable batteries due to its extremely high theoretical specific capacity (3860 mAh g-1), low density

(0.59 g cm-3), and the lowest negative electrochemical potential (−3.040 V vs. standard hydrogenelectrodes). Unfortunately, uncontrollable dendritic Li growth and limited Coulombic efficiency during Li deposition/stripping inherent in these batteries have prevented their practical applications over the past 40 years. With the emergence of post Liion batteries, safe and efficient operation of Li metal anodes has become an enabling technology which may determine the fate of several promising candidates for the next generation energy storage systems, including rechargeable Li-air batteries, Li-S batteries, and Li metal batteries which utilize intercalation compounds as cathodes. In this work, various factors that affect the morphology and Coulombic efficiency of Li anodes are analyzed. The authors also present the technologies utilized to characterize the morphology of Li deposition and the results obtained by modeling of Li dendrite growth. Finally, recent developments, especially the new approaches that enable safe and efficient operation of Li metal anodes at high current densities are reviewed. The urgent need and perspectives in this field are also discussed. The fundamental understanding and approaches presented in this work will be critical for the applicationof Li metal anodes. The general principles and approaches can also be used in other metal electrodes and general electrochemical deposition of metal films.

Battery Systems Engineering

Most vehicles run on fossil fuels, and this presents a major emissions problem as demand for fuel continues to increase. Alternative Fuels and Advanced Vehicle Technologies gives an overview of key developments in advanced fuels and vehicle technologies to improve the energy efficiency and environmental impact of the automotive sector. Part I considers the role of alternative fuels such as electricity, alcohol, and hydrogen fuel cells, as well as advanced additives and oils, in environmentally sustainable transport. Part II explores methods of revising engine and vehicle design to improve environmental performance and fuel economy. It contains chapters on improvements in design, aerodynamics, combustion, and transmission. Finally, Part III outlines developments in electric and hybrid vehicle technologies, and provides an overview of the benefits and limitations of these vehicles in terms of their environmental impact, safety, cost, and design practicalities. Alternative Fuels and Advanced Vehicle Technologies is a standard reference for professionals, engineers, and researchers in the automotive sector, as well as vehicle manufacturers, fuel system developers, and academics with an interest in this field. Provides a broad-ranging review of recent research into advanced fuels and vehicle technologies that will be instrumental in improving the energy efficiency and environmental impact of the automotive sector Reviews the development of alternative fuels, more efficient engines, and powertrain technologies, as well as hybrid and electric vehicle technologies

Electric Vehicle Batteries: Moving from Research towards Innovation

This new edition includes approximately 30% new materials covering the following information that has been added to this important work: extends the contents on Li-ion batteries detailing the positive and negative electrodes and characteristics and

other components including binder, electrolyte, separator and foils, and the structure of Li-ion battery cell. Nickel-cadmium batteries are deleted. adds a new section presenting the modelling of multi-mode electrically variable transmission, which gradually became the main structure of the hybrid power-train during the last 5 years. newly added chapter on noise and vibration of hybrid vehicles introduces the basics of vibration and noise issues associated with power-train, driveline and vehicle vibrations, and addresses control solutions to reduce the noise and vibration levels. Chapter 10 (chapter 9 of the first edition) is extended by presenting EPA and UN newly required test drive schedules and test procedures for hybrid electric mileage calculation for window sticker considerations. In addition to the above major changes in this second edition, adaptive charging sustaining point determination method is presented to have a plug-in hybrid electric vehicle with optimum performance.

Hybrid Electric Vehicle System Modeling and Control

A theoretical and technical guide to the electric vehicle lithium-ion battery management system Covers the timely topic of battery management systems for lithium batteries. After introducing the problem and basic background theory, it discusses battery modeling and state estimation. In addition to theoretical modeling it also contains practical information on charging and discharging control technology, cell equalisation and application to electric vehicles, and a discussion of the key technologies and research methods of the lithium-ion power battery management system. The author systematically expounds the theory knowledge included in the lithium-ion battery management systems and its practical application in electric vehicles, describing the theoretical connotation and practical application of the battery management systems. Selected graphics in the book are directly derived from the real vehicle tests. Through comparative analysis of the different system structures and different graphic symbols, related concepts are clear and the understanding of the battery management systems is enhanced. Contents include: key technologies and the difficulty point of vehicle power battery management system; lithium-ion battery performance modeling and simulation; the estimation theory and methods of the lithium-ion battery state of charge, state of energy, state of health and peak power; lithium-ion battery charge and discharge control technology; consistent evaluation and equalization techniques of the battery pack; battery management system design and application in electric vehicles. A theoretical and technical guide to the electric vehicle lithium-ion battery management system Using simulation technology, schematic diagrams and case studies, the basic concepts are described clearly and offer detailed analysis of battery charge and discharge control principles Equips the reader with the understanding and concept of the power battery, providing a clear cognition of the application and management of lithium ion batteries in electric vehicles Arms audiences with lots of case studies Essential reading for Researchers and professionals working in energy technologies, utility planners and system engineers.

Energy Storage and Management for Electric Vehicles

This book systematically introduces readers to the core algorithms of battery management system (BMS) for electric vehicles. These algorithms cover most of

the technical bottlenecks encountered in BMS applications, including battery system modeling, state of charge (SOC) and state of health (SOH) estimation, state of power (SOP) estimation, remaining useful life (RUL) prediction, heating at low temperature, and optimization of charging. The book not only presents these algorithms, but also discusses their background, as well as related experimental and hardware developments. The concise figures and program codes provided make the calculation process easy to follow and apply, while the results obtained are presented in a comparative way, allowing readers to intuitively grasp the characteristics of different algorithms. Given its scope, the book is intended for researchers, senior undergraduate and graduate students, as well as engineers in the fields of electric vehicles and energy storage.

Alternative Fuels and Advanced Vehicle Technologies for Improved Environmental Performance

In the last few decades, electric drives have found their place in a considerable number of diverse applications. They are successfully replacing some other traditional types of drives owing to their better performance and excellent controllability. The introduction of electric drives is in most cases also beneficial from the ecological point of view as they are not directly dependent on fossil fuels and an increasing part of electric energy they consume is generated in renewable energy sources. This book focuses on applications of electric drives that emerged only recently and/or novel aspects that appear in them. Particular attention is given to using electric drives in vehicles, aircraft, non-road mobile machinery, and HVAC systems.

ROMANCE ACTION & ADVENTURE MYSTERY & THRILLER BIOGRAPHIES & HISTORY CHILDREN'S YOUNG ADULT FANTASY HISTORICAL FICTION HORROR LITERARY FICTION NON-FICTION SCIENCE FICTION